

Diabetes among a TAMILIAN INDIAN COMMUNITY in Cape Town

RE-EXAMINATION AFTER FIVE YEARS

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SUMMARY

A community of Tamil-speaking Indians in Cape Town was found to have an extremely high prevalence of diabetes — 37% over the age of 25 years. Members of this community were considerably inbred; other social and dietary factors did not appear relevant when comparison was made with other Indian groups in Cape Town. The newly-discovered diabetics were younger than the already known diabetics.

Re-examination five years later indicated that 11 (34%) of 32 subjects whose glucose tolerance tests (GTT) had been initially normal, had become diabetic, and that the mean GTT values of originally normal and originally diabetic subjects had greatly increased. Prolonged GTTs did not indicate any particular tendency to reactive hypoglycaemia in this potentially diabetic community. Growth hormone levels tended to be high and poorly suppressed compared with those of a control group. We conclude that genetic influences may be extremely important in determining the incidence of maturity-onset diabetes, at least among certain communities.

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In the course of a population study of (East) Indians in Cape Town in 1965 a community of Tamil-speaking Hindus was found to have strikingly higher blood sugar levels and more diabetes than other Indians. Many apparently unrelated individuals were observed to have common ancestors, and the unravelling of the whole pedigree revealed that all members of this community comprised one single large family.¹ The high prevalence of diabetes in this family correlated with the finding of several husband/wife diabetic pairs and numerous 'genetic-prediabetic connubial offspring', who have been the subject of separate reports.²⁻⁴ A socio-economic and dietary study of the family was also made.

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Five years later, in 1970, we were able to re-examine a number of the family members, and found that the incidence of diabetes developing in that 5-year period was much greater than that previously reported in high-risk subjects.

SUBJECTS

Tamil-speaking Hindus were brought from India, mainly from the Madras area, to work on the sugar plantations in Natal around 1860, and a few later made their way south to Cape Town. They are mostly small shopkeepers or they work in the hotel trade, mainly as waiters.

Social features of this group include: great strength of family ties, emphasis on 'arranged' marriages, several related families occupying single houses, and virtual absence of people living alone.

Tamil Indians permit, and to some extent encourage, close-kin marriages. Until recently a man had the prescriptive right to marry his sister's daughter—seldom enforced nowadays—but two such marriages are included in the present family. Cousin marriages are common—in particular the 'cross-cousin' marriage between children of sisters and brothers.

Dietary Notes

Compared with other Indian groups the Tamil family had the lowest food expenditure per unit person. Their mean annual sucrose intake was calculated as 23 kg, compared with a mean of 26.3 kg for all Indians, and an intake of 58 kg for English-speaking Indians; their intake of fat was also the lowest of all groups studied.

Persons Studied

In 1965 there were almost 400 living members of the family—311 over 10 years old. Of these, 266 (85%) were screened and/or received full glucose tolerance tests (GTTs). Many members of this extended family could be traced back for 5 generations (Fig. 1). Deceased members were accepted as diabetic only when this was substantiated by at least two family members, or by doctors or hospital records. Ten definite connubial diabetic pairs were discovered, who had 93 living children.

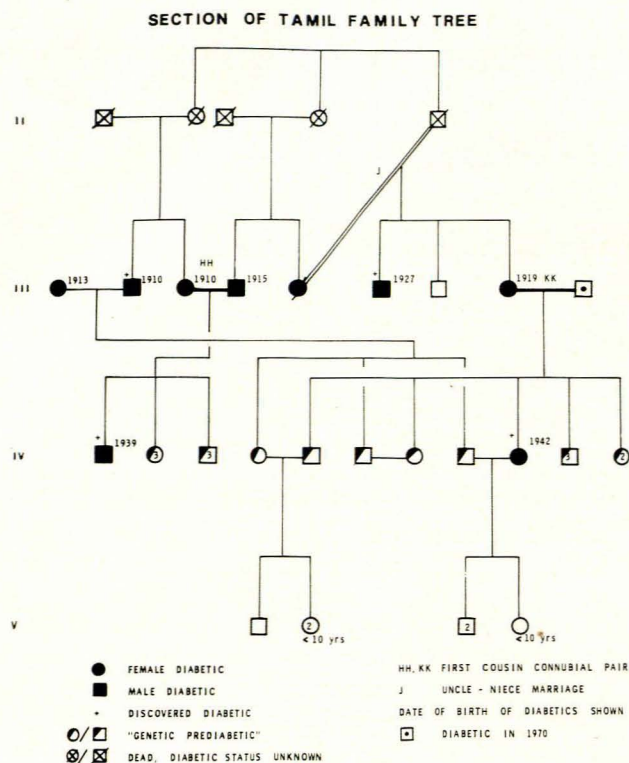


Fig. 1. This section of the complete family chart includes one uncle-niece and several cousin marriages; also two diabetic couples and their connubial offspring (genetic prediabetics).

METHODS

1965 Survey

We attempted to screen all members over the age of 10 years. Co-operation from the family was good, and most of those not screened were away from home or ill at the time.

Screening was by urine and capillary blood sugar estimations one hour after 50 g of oral glucose, using a Hagedorn-Jensen blood sugar method. All those who screened positive with glycosuria or blood sugar over 160 mg/100 ml were then given a full oral GTT. Full GTTs were also performed on as many connubial offspring as possible (65), with or without preliminary screening.

Discovered diabetes was diagnosed on a positive screen and 2 of 3 abnormal values at GTT, i.e.

- fasting level > 120 mg/100 ml;
- maximum level > 200 mg/100 ml;
- 2-hour level > 140 mg/100 ml.

'Borderline' indicates one of these 3 values abnormal.

'Known diabetes' was confirmed by blood sugar levels or medical records.

1970 Retesting

Full GTTs were performed on available members of the family previously screened, and who were not under

active treatment for diabetes. By this time many subjects had moved away and co-operation was generally much poorer. In all, 40 members who had had full GTTs in 1965 were retested, together with 37 others who had screened negative in 1965, and 26 unrelated Tamil Indian controls living in the same area.

Venous blood was sampled by an indwelling catheter in the fasting state and every 30 minutes for at least 3 hours (often up to 5 hours), and analysis performed by AutoAnalyzer (Hoffman). Serum insulin⁴ and growth hormone levels were also measured. Criteria for diabetes diagnosis were maintained as above, since we have shown in our laboratory that the two methods yield very similar results.

Heights and weights were measured in all subjects and calculations of degree of overweight made from *Documenta Geigy* average tables, as corrected for age and sex. The term 'obese' is used for overweight of 15% or more. Skinfold thickness measurements were also taken with calipers at 3 sites in 46 subjects, comprising a cross-section of age groups, diabetics and non-diabetics, and both sexes (reported in detail elsewhere).⁵

RESULTS

1965 Study

Excluding connubial offspring, 54 out of 201 subjects screened positive. We found that 6,8% of this community over 10 years of age were already known diabetics, and a further 10,9% were discovered to be diabetic; thus 17,7% was the total of diabetics (Table I). Over the age of 25 years, 37% were diabetic. Four teenagers were found to be diabetic.

DIABETES IN TAMIL FAMILY

	Whole Family	Connubial Offspring
Known	21	3
Discovered	32	7
Total (over 10 years)	53/311 = 17%	10/69 = 14%
(over 25 years)	38%	28%

(M=F)

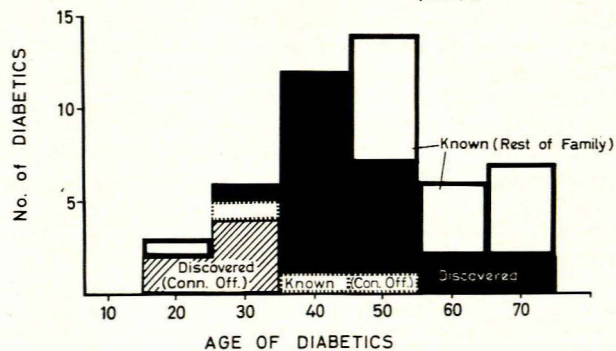


Fig. 2. Already known and newly discovered diabetics among connubial offspring and rest of family in 1965. Black rectangles indicate discovered diabetics among the rest of the family. Discovered diabetics tend to be younger than known diabetics.

TABLE I. TAMIL FAMILY — 1965 RESULTS

Age (yrs)	Interviewed			Known diabetic		Discovered diabetic		Total diabetic
	No.		% of total	Male	Female	Male	Female	
	Male	Female						
10 - 14	34	36	24	0	0	0	1	1,6
15 - 34	84	84	52	0	2	2	8	8,6
35 - 54	26	28	18	3	7	10	4	52,5
55 +	12	7	6	4	5	4	0	68,0
Total	156	155		7	14	16	13	17,7%
				6,8%		10,9%		

The sex distribution was roughly equal, although more known diabetics were female (Table I). The actual numbers of diabetics in different decades are shown in Fig. 2.

Of the 93 connubial offspring 65 received GTTs and 14% were diagnosed diabetic; 28% were over the age of 25 years (Fig. 2).

During the same period we were investigating other Hindu Indian populations,⁶ and found a total diabetes prevalence of 8,4% over 10 years of age.

1970 Study

Of the 40 subjects who had screened positive in 1965 and were retested in 1970, 8 had been diagnosed diabetic in 1965; 7 of these now gave grossly diabetic GTTs; 1 was normal. The mean blood glucose levels of the 1965 diabetics were significantly higher at all times in 1970, despite the one normal curve (Fig. 3). The normal curve was given by a girl of 19 years, whose blood glucose had exceeded 200 mg/100 ml in 1965, and who then had glycosuria. She had received no treatment and her weight/height ratio had not changed.

Of the 32 subjects with normal GTTs in 1965, 11 now yielded diabetic tests (34%); (one or more of the values exceeded 200 mg/100 ml in every case). Their age distribution is shown in Table II. Their mean blood glucose levels were significantly higher in 1970 at all times. Of these subjects 22 were offspring of diabetic couples and 5 of these were found to be diabetic (24%).

TABLE II. 1970 RETESTING OF 1965 NON-DIABETICS

Age (yrs)	No.	Diabetic
15 - 34	20	4
35 - 54	9	5
55 +	3	2
Total	32	11 (34%)

Of the 37 subjects who had screened negative in 1965, 5 now gave borderline GTTs and 1 was diabetic. However, only 4 of these were over 35 years of age and all 4 were abnormal. The mean age of the remainder was \pm 25 years.

MEAN GTTs OF 8 DIABETICS DISCOVERED 1965 RETESTED 1970

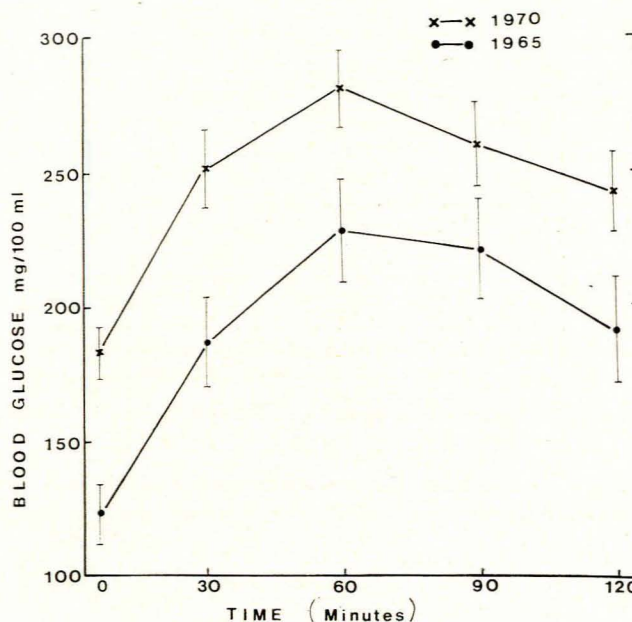


Fig. 3. Higher mean GTT values among discovered diabetics in 1970 than in 1965.

Only 4 of the 66 non-diabetic subjects, whose GTTs were continued with half-hourly readings, up to 5 hours, showed any values below 60 mg/100 ml. In one of these subjects both parents were diabetic, in 2 one parent was diabetic, and the other was a control. The various groups, i.e. 2 parents diabetic, one parent diabetic, both parents normal, and controls, showed no appreciable difference in their mean late blood glucose levels (Table III). No late hypoglycaemic levels were found in the borderline or diabetic subjects.

Of the 46 subjects who were weighed and measured by calipers all but 8 were found to be predominantly endomorphic,⁵ while 15 of 31 women were obese by height/weight ratio, but none of the 15 males.

TABLE III. BLOOD GLUCOSE VALUES DURING 5-HOUR GTT (1970) (MEANS IN mg/100 ml)

	No.*	Fasting	0,5	1	1,5	2	2,5	3	3,5	4	4,5	5 Hours
Diabetic	14	165	229	257	231	212	195	196	179	161	145	144
Borderline†	9	111	166	168	140	115	101	97	92	97	95	98
Normal GTT												
2 Parents diabetic	10	104	143	139	115	101	90	87	82	81	83	89
1 Parent diabetic	15	97	134	135	111	91	84	79	82	86	89	90
0 Parent diabetic	15	99	136	120	110	100	86	84	89	92	92	91
Control subjects	26	94	132	128	109	89	79	78	77	80	82	84

* Numbers of subjects who had 3-hour GTT were greater.

† Borderline = one abnormal blood glucose value during first 2 hours.

Growth Hormone Values (1970)

Mean growth hormone (HGH) figures for all members of the Tamil family were higher and less suppressed by glucose than those of the control subjects (Fig. 4). These differences were not statistically significant.

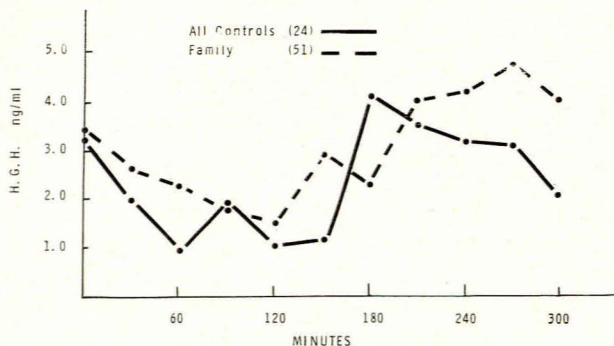


Fig. 4. Mean HGH values of Tamil family and control Tamils during prolonged oral glucose tolerance test.

Family members with normal GTTs and both parents diabetic showed very little suppression of HGH levels by glucose, while those with neither parent diabetic showed good suppression (Fig. 5). The numbers in these groups are too small and standard errors too large for significance to be claimed.

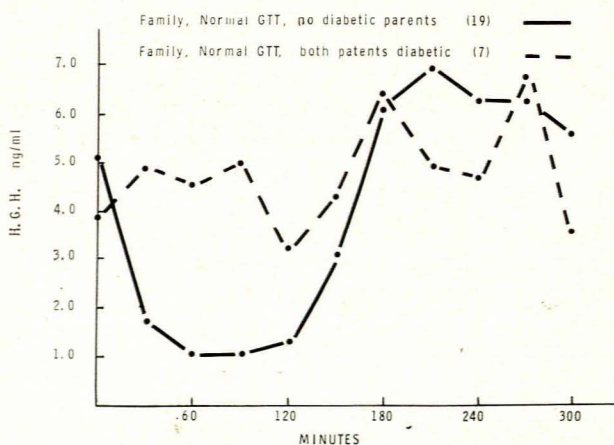


Fig. 5. Mean HGH values during prolonged oral glucose tolerance tests. Subjects with 2 diabetic parents show poor suppression to glucose.

DISCUSSION

The community of Tamil (East) Indians reported here appears to have an extremely high prevalence of diabetes (37% over the age of 25 years in 1965)—perhaps only equalled by the Pima (American) Indians.⁶ The validity of this assertion is supported by the observation that one-third of the total diabetics were already known, symptomatic and under treatment at the time of the survey, that diagnosed diabetics had shown hyperglycaemia on at least 3 occasions on 2 different days, and that our criteria for diagnosis are relatively stringent. (Most standard criteria for assessing diabetes from the GTT are more lax than ours, and would have indicated an even higher prevalence.⁷) A population study performed in the same year found that the frequency of diabetes among other Hindu Indian communities in Cape Town was also high, but less than half that of the Tamil group under present consideration.⁷

The high frequency of diabetes in this family does not seem likely to be directly due to eating habits or obesity, since its members are in general rather poorer than other Indian communities and eat less refined carbohydrate and fat. Although Tamil women are frequently obese, they are no fatter than other Indian women in Cape Town.⁷ Furthermore, the men of the family are not overweight, but have as much diabetes and as high blood glucose levels as their womenfolk.

In most surveys newly discovered diabetes is particularly frequent in the sixth or seventh decade of life,⁷⁻¹² whereas among this Tamil community the majority were in the fifth decade (Fig. 2) and were younger than the already known diabetics, while the discovered diabetics among the connubial offspring were younger still. We have argued elsewhere that multiple genetic abnormalities tend to produce earlier diabetes rather than more diabetes.²

The mean GTT values of groups of normal subjects, 'potential' diabetics, borderline, or asymptomatic 'chemical' diabetics usually show little change on retesting after a period of months or years,¹³⁻¹⁵ or even an improvement (because of the natural individual fluctuations of blood glucose levels, as discussed elsewhere).¹⁷ We have observed this ourselves among a series of 100 middle-aged subjects chosen as potential diabetics; their mean GTT values, analysed over the first 5 years, had actually improved (to be published later as part of a trial under the auspices of the British Diabetic Association). In another study, GTTs were performed and repeated one year later on members who took part in a Cape Coloured population survey. The repeat GTTs showed no change in mean

values in the group who were originally normal, and considerable improvement in those who were borderline, and in those who were discovered chemical diabetics without treatment.¹⁷

Among the Tamils, on the other hand, mean GTT values of the originally GTT-normal 32 subjects and of the 8 discovered diabetics were much higher, while the astonishing number of 11 (34%) of the former were now diabetic by definition. Even among those 37 who had screened negative in 1965, all 4 over the age of 35 years gave abnormal GTTs in 1970. These findings and the differences between this inbred Tamil group and other Hindu communities, point to the importance of genetic influences. We are cautious about accepting the prevalence rate of a small closed community as indicating anything more than the effects of genetic drift, assuming a high concentration of diabetic genes in the progenitors of the community.

It is generally agreed that reactive hypoglycaemia occurring some 2-5 hours after a carbohydrate load is particularly common as a very early feature of diabetes. We were therefore surprised to find virtually no evidence of late hypoglycaemia in these highly potentially diabetic Tamil Indians. We were unable to show that blood glucose dropped any lower in non-diabetics with 2 diabetic parents than in non-family controls (Table III). In this community then, reactive hypoglycaemia was not, apparently, a prediabetic phenomenon of any importance.

Several previous reports on the offspring of diabetic couples have appeared,¹⁷⁻²¹ and the prevalence of diabetes among them has mostly been around 5%. In the largest series known to us, from Rumania, 28% of 1 173 offspring were diabetic.²² Among our 899 Indian connubial offspring in Durban the frequency of known diabetes was 6.6%, but 13.3% were diabetic on glucose tolerance testing.² Among the presently considered Tamil community the relatively low initial prevalence of 14% among connubial offspring, compared with 18% for the whole community, probably simply reflected the youth of these offspring. That 24% of the normal offspring retested 5 years later had become diabetic must indicate an extremely high eventual prevalence. The incidence (i.e. attack rate) may not continue to be high, however, since we have shown that the difference in frequency of diabetes between connubial offspring and general population lessens with age.²

The possible role of growth hormone in the pathogenesis of diabetes is still speculative. Some workers have reported significantly raised and poorly suppressed HGH

levels in prediabetic or potentially diabetic groups; others have not found this.²³ The present Tamil community is certainly highly potentially diabetic as a group. Our results show a pattern of HGH responses to oral glucose that is consistent with the suggestion that potential diabetics show less suppression of HGH than normal.

In conclusion, our findings indicate a progressive deterioration in glucose tolerance in potential (genetically abnormal) diabetics and in mild chemical diabetics, under the combined influence of genetic and environmental factors. Diabetes among Indians is of the maturity-onset type, even in young people, and very rarely leads to ketosis or requires insulin. Genetic factors are evidently of great importance in this variety of maturity-onset diabetes, although their importance has been doubted among Whites.¹⁷

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